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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
KANG, DONGHEE	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 12/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/039,215	BASCERI ET AL.	
	Examiner	Art Unit	
	Donghee Kang	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6, 8-18, 20-30, 32-44 & 46-47* is/are rejected.

7)☒ Claim(s) *7,19,31 and 45* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10-14-04 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims **22, 26, 27, 29, 30, 32-36, 40-41, 43-44 & 46-47** are rejected under 35 U.S.C. 102(e) as being anticipated by Miki et al. (US6,309,894).

Re claim **22**, Miki et al. teach a CIC device comprising (Fig.1):

a lower electrode (102); a dielectric layer (103) formed on the lower electrode, wherein the dielectric layer comprises a first concentration of oxygen vacancies; and an upper electrode (105) formed on the dielectric layer, wherein the upper electrode is deposited in a strongly oxidizing ambient selected so as to form a highly oxidized upper

electrode with an oxygen-rich interface layer (104) at the interface between the dielectric layer and the upper electrode that subsequently absorbs the displaced oxygen vacancies migrating out of the dielectric layer while oxidizing the dielectric layer to thereby reduce the concentration of oxygen vacancies in the dielectric layer from the first concentration, and wherein reducing the concentration of oxygen vacancies in the dielectric layer provides the CIC device with increased capacitance and wherein the oxygen atoms in the upper electrode absorbs oxygen vacancies that migrate into the second electrode. See also Col.7, lines 59-Col.8, line 54.

Miki et al. do not explicitly teach " the quantity of oxygen atoms within the upper electrode is greater than that which is required for stoicheometric stability". However, this feature is inherent in Miki's device because the upper electrode in Miki's device also includes oxygen atoms to absorb oxygen vacancies.

Re claims **26 & 40**, Miki et al. teach the upper electrode comprises a plurality of oxygen-rich regions that are distributed throughout the upper electrode, said regions absorbing oxygen vacancies that migrate through the upper electrode.

Re claims **27 & 41**, Miki et al. teach the upper electrode comprises a platinum (Pt).

Re claims **29 & 43**, Miki et al. teach the upper electrode is highly oxidized.

Re claims **30 & 44**, Miki et al. teach the upper electrode has a quantity of oxygen atoms.

Re claims **32 & 46**, Miki et al. teach the lower electrode comprises a platinum (Pt).

Re claims **33 & 47**, Miki et al. teach the structure of the dielectric layer is a crystalline structure.

Re claim **34**, Miki et al. teach a CIC structure comprising (Fig.1):

first (102) and second (105) conductive layers; an insulating layer (103) interposed between the first and second conductive layers; wherein the insulating layer includes a plurality of oxygen vacancies; and an interface layer (104) interposed between the insulating layer and the second conductive layer, wherein the interface layer includes an increased concentration of oxygen atoms such that a portion of oxygen vacancies in the insulating layer migrate toward the interface layer.

Miki et al. do not teach exposure an electric field. A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Miki et al. do not explicitly teach " the quantity of oxygen atoms within the upper electrode is greater than that which is required for stoicheometric stability". However, this feature is inherent in Miki's device because the upper electrode in Miki's device also includes oxygen atoms to absorb oxygen vacancies.

Re claim **35**, Miki et al. teach the insulating layer is deposited over the first conductive layer, and wherein the insulating layer comprises a plurality of oxygen cites that are partially filled with a plurality of oxygen atoms, and wherein the unfilled oxygen cites define a first concentration of oxygen vacancies.

Re claim **36**, Miki et al. teach the second conductive layer is deposited over the insulating layer, and wherein the interface layer is deposited between the insulating layer and the second conductive layer, wherein the interface layer absorbs oxygen vacancies that migrate from the first conductive layer so as to reduce the buildup of oxygen vacancies at the interface layer and so as to reduce the first concentration of oxygen vacancies of the insulating layer.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims **28 & 42** are rejected under 35 U.S.C. 103(a) as being unpatentable over Miki et al. in view of Moise et al. (US 6,211,035).

Miki et al. teach the substantially the entire claimed structure, as applied to claim 1 explained above, except that the second conducting layer having a thickness between 100 Å and 2000 Å. However, Moise et al. teach the upper electrode having a thickness 60 nm which is in the claimed ranges (Col.9, lines 13-14). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the upper electrode having a thickness between 100 Å and 2000 Å as taught by Moise in Miki's device, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

6. Claims **1-3, 5-6, 8-15, 17-18, 20-21, 23-24 & 37-38** are rejected under 35 U.S.C. 103(a) as being unpatentable over Miki et al. in view of Shin et al. (US 6,103,567).

Re claim **1**, Miki et al. teach an integrated circuit comprising an improved conductor-insulator-conductor (CIC) sandwich, wherein the CIC sandwich comprises (Fig.1):

a first conducting layer (102); a first insulating layer (103) deposited over the first conducting layer, wherein the first insulating layer comprises a structure having a plurality of oxygen cites partially filled by a plurality of oxygen atoms, wherein the unfilled oxygen cites define a concentration of oxygen vacancies; a second conducting layer (105) deposited over the first insulating layer; and an oxygen-rich interface layer (104) interposed between the first insulating layer and the second conducting layer, wherein the oxygen-rich interface layer acts as a sink for absorbing oxygen vacancies that migrate from the first insulating layer so as to reduce the buildup of oxygen vacancies at the interface layer and so as to reduce the concentration of oxygen vacancies of the first insulating layer (Col.4, line 11-Col.6, line 34).

Miki et al. do not explicitly teach " the quantity of oxygen atoms within the upper electrode is greater than that which is required for stoicheometric stability". However, this feature is inherent in Miki's device because the upper electrode in Miki's device also includes oxygen atoms to absorb oxygen vacancies.

Miki et al. do not teach three-dimensional contour for capacitor. However, it is art recognized to increase the capacitance of a capacitor and also Shin teaches three dimensional capacitor to increase the capacitance of a capacitor (Col.1, lines 34-36).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make a capacitor having a three dimensional form in order to increase the capacitance.

Re claims **2 & 14**, Miki et al. teach the second conducting layer comprising a plurality of oxygen-rich regions that are distributed throughout the second conducting layer, said regions absorbing oxygen vacancies that migrate through the second conducting layer (Col.4, lines 28-33).

Re claims **3 & 15**, Miki et al. teach the second conducting layer comprising platinum (Pt).

Re claims **5 & 17**, Miki et al. teach the conducting layer is highly oxidized.

Re claims **6 & 18**, Miki et al. teach the second conducting layer having a quantity of oxygen greater than that which is required for stoichiometric stability.

Re claims **8 & 20**, Miki et al. teach the first conducting layer comprising platinum (Pt).

Re claims **9 & 21**, Miki et al. teach the structure of the first insulating layer is a crystalline structure (Col.4, lines 40-54).

Re claims **10-12, 23-24, & 37-38**, Miki et al. teach a CIC structure comprising (Fig.1):

A first electrode layer (102); a dielectric layer (103) formed on the first electrode layer so as to overlies the first electrode layer, wherein the dielectric layer defines a structure having a first concentration of oxygen vacancies; and a second electrode layer (105) formed on the dielectric layer so as to overlies the dielectric layer, wherein the second electrode layer is formed in a strongly oxidizing ambient selected so as to diffuse at least a portion of the oxygen atoms into the dielectric layer to thereby reduce the concentration of oxygen vacancies in the dielectric layer from the first concentration and so as to define an oxygen-rich interface layer (104) between the second electrode layer and the dielectric layer that subsequently absorbs the displaced oxygen vacancies migrating out of the dielectric layer, wherein reducing the concentration of oxygen vacancies in the dielectric layer provides the first electrode layer with improved electrical characteristics. See also Col.7, lines 59-Col.8, line 54.

Miki et al. do not explicitly teach " the quantity of oxygen atoms within the upper electrode is greater than that which is required for stoicheometric stability". However, this feature is inherent in Miki's device because the upper electrode in Miki's device also includes oxygen atoms to absorb oxygen vacancies.

Miki et al. do not teach three-dimensional capacitor formed in the via. However, it is art recognized to increase the capacitance of a capacitor and also Shin teaches three dimensional capacitor to increase the capacitance of a capacitor (Col.1, lines 34-36).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make a capacitor having a three dimensional form in order to increase the capacitance.

7. Claims **4 & 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Miki et al. in view of Shin et al. and further in view of Moise et al. (US 6,211,035).

Neither Miki et al. nor Shin teach the second conducting layer having a thickness between 100 Å and 2000 Å. However, Moise et al. teach the upper electrode having a thickness 60 nm which is in the claimed ranges (Col.9, lines 13-14). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the upper electrode having a thickness between 100 Å and 2000 Å as taught by Moise in Miki's device, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Allowable Subject Matter

8. Claims 7, 19, 31 & 45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Prior art reference, taken along or in combination, do not teach or render obvious that the second conducting layer comprising a layer of IrO_x such that x is greater than 2.0 and less than 2.5.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 571-272-1656. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Donghee Kang, Ph.D.
Primary Examiner
Art Unit 2811

dhk